EFECT OF TREADMILL GRADE ON ACTIVATION OF LOWER LIMB MUSCLES DURING HOCKEY STRIDE

Scott McGrail, Tegan Upjohn, and René Turcotte
Biomechanics, McGill University, Montréal, Québec, Canada

INTRODUCTION: In order to gain a performance specific advantage, the skating treadmill has been used in research/training to simulate on-ice skating conditions. The treadmill allows accurate reproduction of the forward power skating stride. The skating stride is biphasic and can be broken down into the support phase; single support and double support, and the swing phase. (Pearsall et al, 2000) During single support the hamstrings are active while during double support, there is an explosive generation of power at the knee joint caused by the quadriceps. (Humble et al, 1988, Pearsall et al, 2000) The purpose of this study was to determine the effect of treadmill grade on lower limb muscle activation patterns (electromyography) and kinematics (high speed filming) during forward power skating.

METHOD: 4 male elite hockey players from the McGill varsity hockey team participated in this study. Data collection took place on the Skating Treadmill (Acceleration Canada) in the Seagram Sports Centre at McGill University. Subjects completed three separate 30 minute familiarization periods on the treadmill. (Nobes et al, 2003) Subjects then completed three 45 second trials at 2% grade (Hinrichs, 1994), 6% grade and 12% grade, each separated by a 5 minute rest period. While skating on the treadmill, the subjects carried a portable data logger (Me3000p8F-1-40UK Biomation/Mega electronics limited) weighing approximately 500g in a fanny pack strapped around the waist. Previous studies revealed no measurable differences in EMG recordings due to the extra weight of the data logger. (DeBoer et al, 1986, Ingen Schenau et al, 1985) Electromyography Kendall Meditrace (Ludlow Company Lp) Ag-AgCl electrodes were used to measure the electrical activity on the right leg of the gluteus maximus, rectus femoris, vastus lateralis, biceps femoris, gastrocnemius and tibialis anterior. Data was collected at 1000 Hz and was filtered using a Butterworth filter, with a lower cutoff frequency of 20 Hz. (fl) 4th order. Foot Switches were used to illicit heel strike and toe off. Kinematic analysis A high speed camera set at 250 Hz and placed in the sagittal plane (motion scope, High speed imaging Inc), was linked through an EMG channel in the data logger. High speed imaging and EMG signals were synchronized via signal triggering from the camera. All data was collected online.

RESULTS AND DISCUSSION: It is expected that there will be an increase in magnitude of muscle activation when comparing the 2% grade with the inclined trials, as well as an increased stride rate.

RELEVENCE: The goal of the present study is to determine muscle activation patterns and EMG magnitude as inclination of the skating treadmill increases. By training at an increased inclination the player will gain a competitive advantage due to increased muscle activation.

REFERENCES:

De Boer, et al. (1986). Characteristic Stroke Mechanics of Elite and Trained Male Speed Skaters. Int. J.S. Biom, 2, 175-185.
Hinrichs, et al. (1994). EMG activity of ice skating and treadmill skating in hockey players. Unpublished thesis. St. Cloud State University, St.-Cloud. MN.
Humble, R., Neil, et al. (1988). The Biomechanics of Forward Power Skating. Clin. Pod Med Surgery, 5(2), 363-376.
Ingen Schenau et al. (1985). The control of speed in elite female speed skaters. J.Biom, 18, 91-96.
Nobes et al. 2003. A comparison of skating economy on-ice and on the skating treadmill. C.J.A.P. 28(1), 1-11.